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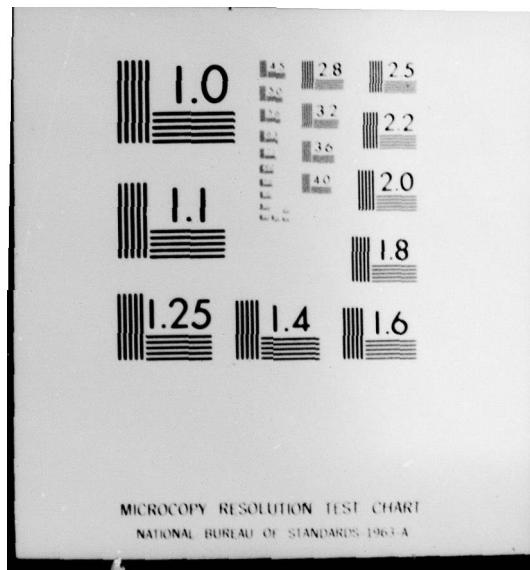
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NWHC REPORT 7796
31 DECEMBER 1977

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NAVAL WEAPONS HANDLING CENTER

TECHNICAL REPORT

TEST AND EVALUATION
OF
UNIVERSAL CONTAINER
FOR
MK 48 MOD 1 TORPEDO
MAJOR GROUPS



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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 14 NWHC-7796	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and subtitle) 6 Test and Evaluation of Universal Container for Mk 48 Mod 1 Torpedo Major Assemblies Mod 1 Groups		5. TYPE OF REPORT & PERIOD COVERED 91 Final report
7. AUTHOR(s) 10 M. Pyrda		6. PERFORMING ORG. REPORT NUMBER 7796
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Weapons Handling Center Naval Weapons Station Earle		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Weapons Handling Center Colts Neck, N.J. 07722		12. REPORT DATE 31 December 1977
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 1
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		15. SECURITY CLASS. (of this report) 12/14 p.
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Test & Evaluation Selection of worth assessment Selection strategies Test Container Delphi procedure Subjective evaluation Mk 48 Mod 1 Torpedo, Major Groups Judgment 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report details the test and evaluation of a first article container designed to ship and store the five major assemblies of the Mk 48 Mod 1 Torpedo. The test container was confirmed for the warhead section only, and the results indicated that the container adequately protects that section.		
DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE		Unclassified SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LP-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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NWHC REPORT 7796
31 December 1977

TEST AND EVALUATION OF
UNIVERSAL CONTAINER FOR
MK 48 MOD 1 TORPEDO MAJOR GROUPS

ABSTRACT

This report details the test and evaluation of a first article container designed to ship and store the five major groups of the MK 48 MOD 1 Torpedo. The test container was confirmed for the warhead group only, and the results indicated that the container adequately protects that group.

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100-100000	B-11 SECTION
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INTRODUCTION

The Naval Weapons Handling Center, WPNSTA Earle was tasked to test and evaluate a first article container manufactured by Container Research Corporation under Contract N00406-77-C-0412 for the MK 48 MOD 1 Torpedo major groups. Since the first article container was configured for the Warhead Group, the test program was confined to determining suitability for that group only. The Universal Container was designed at the Naval Torpedo Station, Keyport at the direction of NAVSEASYSOM.

ITEM DESCRIPTION

The Universal Container, Drawing 2814434-4 is a cylindrical-horizontal type, of steel construction; 88 inches long, 38-3/4 inches wide and 38 inches high. The empty weight of the container is 983 lbs. Weight of the test container with the warhead group was 2,049 lbs. The Container consists of upper and a lower shell weldments which are secured together with 22 T-bolt latches. Shock mitigation is provided by a steel shock frame suspended on a maximum of eight lord shear mounts (J-14872) which fasten to the lower shell weldment. The component is secured within the container with two clamping band assemblies fastened to the lower shell weldment.

The basic container's shock frame and lower weldment is universally configured for the five major MK 48 MOD 1 Torpedo groups (Nose-Control Group, Fuel Tank Group, After Body Group, Warhead Group, Exercise Group) by relocating/ adding/removing shear mounts and by repositioning the clamping bands to properly secure the packaged group.

Other features incorporated in the container design include breather valve, humidity indicator, skids, fork pockets, lifting rings, handlift truck adapters, and stacking provisions.

The basic container design is similar to the existing Group I containers (MK 529 MOD 1, MK 530 MOD 1, MK 531 MOD 1, MK 532 MOD 0 and MK 536 MOD 0).

TEST PROCEDURES AND RESULTS

Tests were conducted in accordance with MIL-STD-648, FED-STD-101 and WS 15158 in the following sequence.

1. Container Inspection

The containers were inspected for workmanship and overall envelope dimensions.

RESULTS: Satisfactory.

2. Fit and Compatibility Check

The Torpedo Warhead Group was loaded into the test container in its normal stow position. The clamping bands were secured to the warhead group and torqued to 420 in/lbs. The upper shell weldment was installed and secured to the lower shell weldment by means of the T-bolt latches torqued to 35/40 ft/lbs. Observations were made for ease of loading, fit, compatibility, interference and binding. The Warhead group was then removed from the test container. (See Figures 1 and 2)

RESULTS: Satisfactory fit; no problems encountered in loading and unloading the group in the test container.

3. Hoisting Strength Test (All Fittings)

Test was performed in accordance with paragraph 5.8.1, MIL-STD-648. A four-legged sling (MK 99 MOD 0) was attached to the hoisting fittings of the test container. The four fittings were simultaneously subjected to a tensional load of 10,245 lbs. (5:1 overload) and held for a period of five minutes.

RESULTS: Upon removal of the load there was no evidence of any permanent deformation of any part of the hoisting system.

4. Hoisting Strength Test (Single Fitting)

Test was performed in accordance with paragraph 5.8 of MIL-STD-648. The test container with warhead group installed was hoisted by each of the four hoisting fittings individually. The container was suspended by each fitting for a period of five minutes.

RESULTS: At the conclusion of the test there was no evidence of any permanent deformation of any part of the hoisting fittings or supporting structure.

5. Leak Test (Initial)

The test was conducted in accordance with paragraph 5.5.2, MIL-STD-648. The test container was prepared for testing by sealing the breathing device and inserting suitable pressurizing fittings and gauges. The test container was closed and sealed by the same procedures used in service. The T-bolt latches were torqued to 35/40 ft/lbs. as required. The container was pressurized and monitored for a period of one hour. (See Figure 3)

RESULTS: Start 2.77 psig - End 2.73 psig
Duration of test 1 hr. - change in pressure = 0.04 psig
Ambient Temp = 80°F
Allowable Loss = 0.05 psig

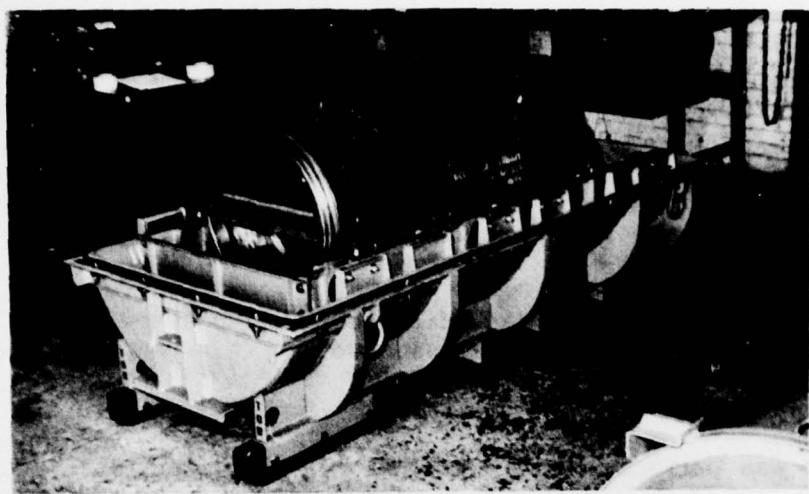


FIG. 1 UNIVERSAL CONTAINER WITH WARHEAD SECTION INSTALLED

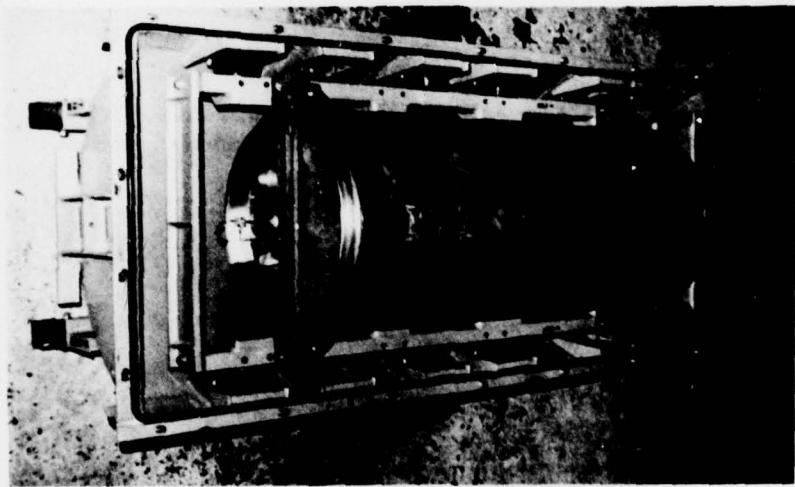


FIG. 2 UNIVERSAL CONTAINER - SHEAR MOUNT ARRANGEMENT W/ WARHEAD SECTION

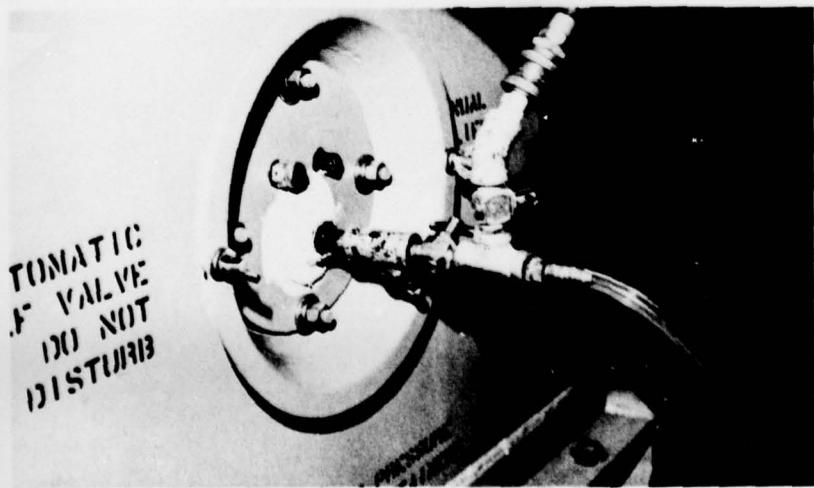


FIG. 3 UNIVERSAL CONTAINER - LEAK TEST ARRANGEMENT

Test container performed satisfactorily

6. Repetitive Shock Test

Test was performed in accordance with paragraph 5.2.2, MIL-STD-648. The test container was subjected to repetitive shock for a period of two hours at one inch vertical double amplitude with all points of the container leaving the table 1/16 inch at some instant during each cycle. Frequency was 3.9 Hz.

RESULTS: Examination after test disclosed no damage to container or warhead group.

7. Resonance Search

Test was performed in accordance with paragraph 5.3.2, MIL-STD-648. The test container, in its normal position, was rigidly attached to a vibration exciter (See Figure 4). A search for resonance was conducted by applying sinusoidal vibration excitation in the vertical direction. Transmissibility data was obtained for the fundamental translational vibration mode over a frequency range of 5-50 Hz. Input vibration was 1.0 g or less.

RESULTS: Satisfactory
Fwd Sta - Freq 12 Hz, Transmiss. 2.5
Aft Sta - Freq 12 Hz, Transmiss. 4.8
Sweep Rate: 5 min \pm 50

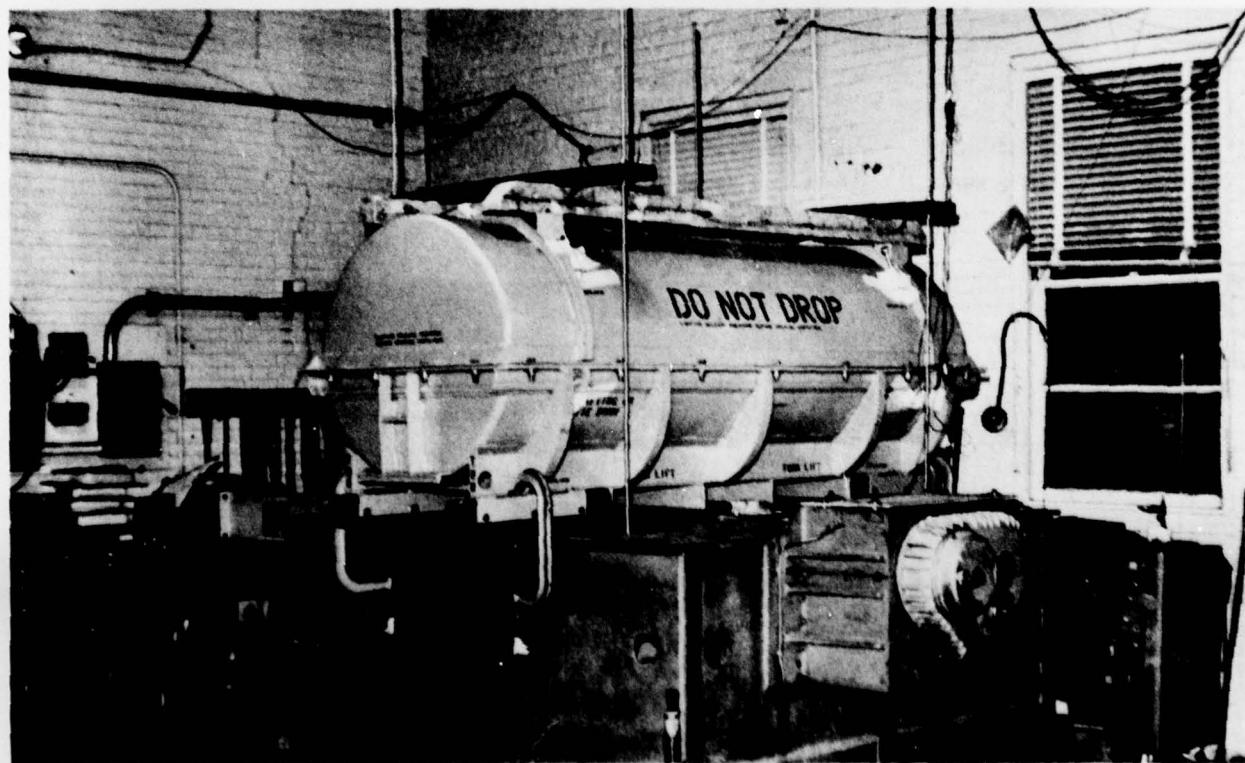


FIG. 4 UNIVERSAL CONTAINER - RESONANCE SEARCH

8. Cornerwise-Drop (Rotational) Test

Test conducted in accordance with paragraph 5.2.4, MIL-STD-648. The test container was conditioned at -20°F and $+140^{\circ}\text{F}$ respectively for periods of not less than six hours. The rotational corner drops were conducted at both temperature extremes. One corner of the test container was supported on a six inch block and the adjacent corner on a 12 inch block. The corner of the container diagonally opposite the 12 inch block was raised to a height of 24 inches and allowed to free-fall and impact on a concrete surface. All four corners of the test container were impacted in this manner.

RESULTS: Satisfactory. The maximum peak shocks recorded were well within the allowable fragility limits, Figure 5.

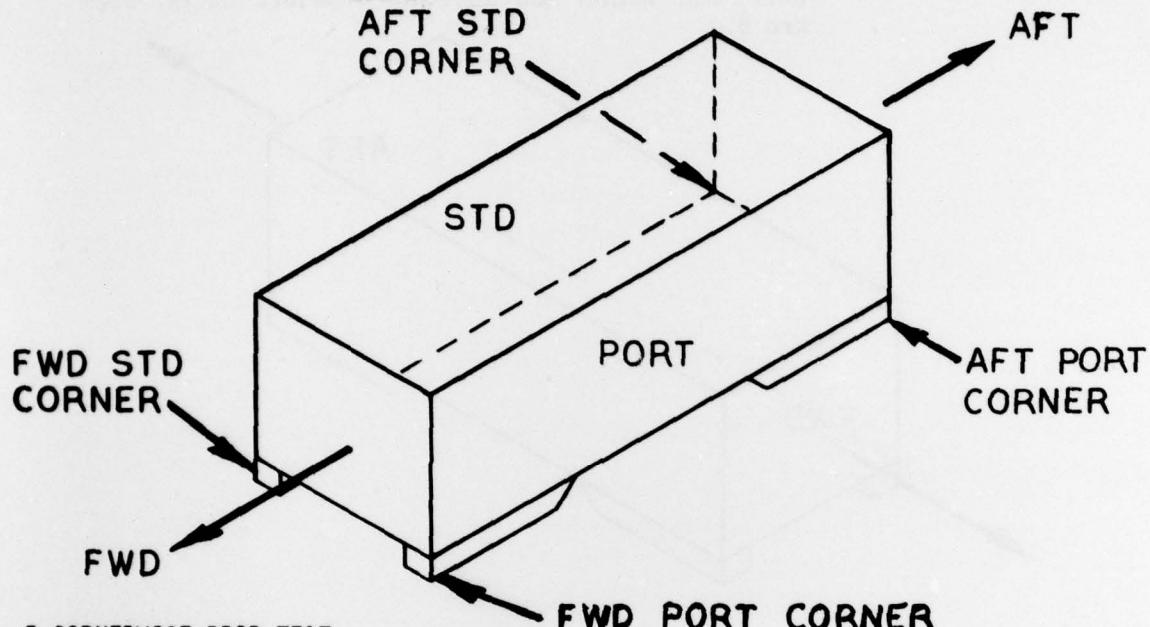


FIG. 5 CORNERWISE DROP TEST

Impact Point	Max. Vert. Excur. @High Temp. (In.)	Decel	Low Temp $-20^{\circ}\text{F}^{\circ}$				Room Temp $^{\circ}\text{F}$				High Temp $+140^{\circ}\text{F}^{\circ}$				
			Dura	Vert	Trans	Long	Result	Vert	Trans	Long	Result	Vert	Trans	Long	Result
FWD PORT CORNER		g/s	18.9	14	3.8	23.8									
		ms	36	15	20										
AFT STD CORNER		g's	23.9	8.8	3.66	25.7									
		ms	43	18.7	25										
FWD STD CORNER		g's									19	5.1	2.5	19.8	
		ms									53.7	18.7	18.7		
AFT PORT CORNER		g's									18.6	8.8	2.47	20.7	
		ms									52.5	40	37.7		

9. Impact Test (End)

Test conducted in accordance with paragraph 5.2.7, MIL-STD-648. The incline-plane test with optional timber was employed. The test container was impacted on both ends at an impact velocity of 10 ft/sec.

RESULTS: Satisfactory. The maximum peak shocks recorded were well within the allowable fragility limits. Figure 6.

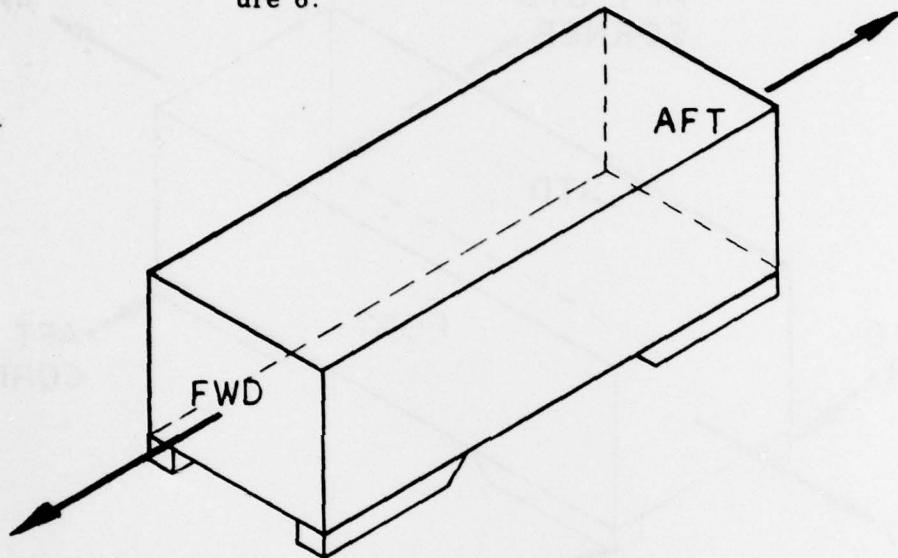


FIG. 6 END IMPACT TEST

Impact Point	Decel. Dura.	Low Temp <u>-20</u> ^o F			Room Temp <u> </u> ^o F			High Temp <u>+140</u> ^o F			Max. Excursion @ High Temp (In.)
		fwd	c.g.	aft	fwd	c.g.	aft	fwd	c.g.	aft	
FWD END	g's	21.6						20.4			
	ms	35		.				47.5			
AFT END	g's			18.3					20.5		
	ms			40					47.5		

Method: Pendulum Conbur (Incline Plane)

Impact Velocity: 10 ft/sec

Optional Timber used? X Yes No

10. Impact Test (Side)

Test conducted in accordance paragraph 5.2.7, MIL-STD-648. The optional timber method was employed. The test container was impacted on both sides at an impact velocity of 7 ft/sec.

RESULTS: Satisfactory. The maximum peak shocks were well within the allowable fragility limits, Figure 7.

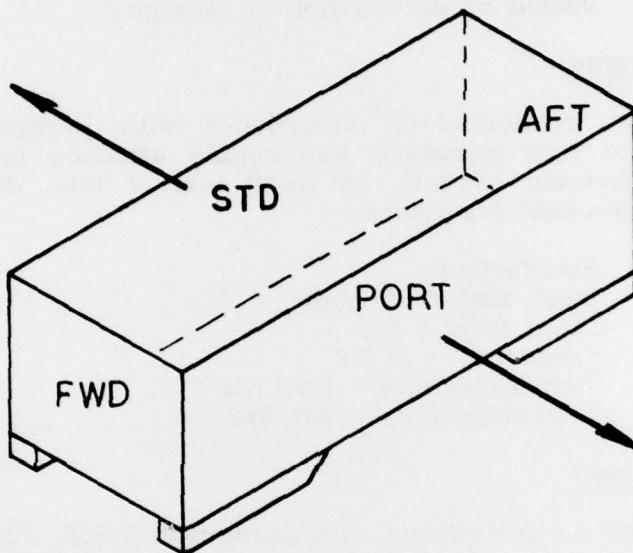


FIG. 7 SIDE IMPACT TEST

Impact	Decel	Low Temp -20°F			Room Temp °F			High Temp +140°F			Max. Excursion @ High Temp (In.)
		Dura.	Trans.		fwd	c.g.	aft	Trans			
PORT	g's	23.6						21			
SIDE	ms	25						26			
STD	g's	23.6						22			
SIDE	ms	23.7						22.5			

Method: Pendulum Conbur (Incline Plane)

Impact Velocity: 7 ft/sec

Optional Timber used? X Yes No

11. Load Test (Stackability)

Test conducted in accordance with paragraph 5.7.2, MIL-STD-648. The test container was subjected to an overload of 4:1 by placing a load weighing 8196 lbs. on the container to simulate the effect of a stack of 5 high containers. The load was maintained on the test container for a period of one hour.

RESULTS: Examination of container after removal of load revealed no deformation or damage.

12. Vibration Fatigue

The test was conducted in accordance with paragraph 5.3.2, MIL-STD-648. The test container was rigidly attached in its normal position to the vibration exciter. A dwell test of total duration was conducted at the resonant frequency.

RESULTS: Satisfactory
Dwell time = 30 mins.
Input level = 1 g
Frequency = 12 Hz
Transmissibility = Fwd Sta 2.5
Transmissibility = Aft Sta 4.8

13. Leak Test (Final)

Test conducted in accordance with paragraph 5.5.2, MIL-STD-648. The test container was prepared for test by sealing the breathing device and inserting pressurizing fittings and gauges. The container shells were sealed by torquing the T-bolt latches to 35/40 ft/lbs. The container was pressurized and monitored for a period of one hour.

RESULTS: Satisfactory
Pressure at start = 2.80 psig
Pressure at end = 2.76 psig
Change in pressure = 0.04 psig
Duration of test = 1 hour
Ambient temp. = 80°F

14. Fork Truck Compatibility Test (Lifting and Transporting)

Test conducted in accordance with paragraph 5.9, MIL-STD-648. The test container was engaged and lifted clear of the ground by means of 4000 lb. capacity electric forklift truck. The container was transported by the forklift truck a distance of approximately 100 feet across a hard, flat area. In addition, the container supported on the forks was transported across an obstacle course of boards positioned across and at specific angles to the line of travel.

RESULTS: The loaded container was easily lifted and transported by means of the forklift truck. The container was safely handled by the forklift truck during transport over both the level area and the obstacle course.

15. Fork Truck Compatibility Test (Pushing and Towing)

Test conducted in accordance with paragraph 5.9, MIL-STD-648. The test container was pushed sideways along a hard, dry pavement by a forklift truck (not raised off ground) for a distance of approximately 35 feet in 85 seconds. A sling was then attached to the test container lifting fittings at one end, and the container was towed approximately 100 feet in 23 seconds. The same towing operation was conducted on the container in the sideway direction.

RESULTS: There was no damage to the container as the result of this test. The test container was easily pushed and towed with no unsafe condition experienced.

16. Handlift Truck Compatibility and Interface Strength

Test conducted in accordance with the provisions of paragraph 4.17.6, MIL-STD-648. The end fittings on the test container were engaged by two handlift trucks, MK 45 (Dwg. 2642780) and the container was raised off the ground. A load of 8,000 lbs was placed on the container for a total overload on the container end fittings of 10,049 lbs. The load was maintained for a period of 5 minutes. (See Figure 8).

RESULTS: The end fittings interface with the MK 45 handlift truck and satisfactorily support the container in an overloaded condition.

CONCLUSION

The container satisfactorily met the test criteria prescribed by the referenced specifications for shipment and storage of the MK 48 MOD 1 Torpedo Warhead Section. The container, although intended for shipment and storage of all five major groups, cannot be certified as "universal" until similar tests are conducted with the remaining four groups.

RECOMMENDATIONS

The following recommendations are made as the result of the foregoing test program:

1. Test the container with each of the remaining four major torpedo groups.
2. Identify the shear mount location for each major torpedo groups by stencil on the Shock Frame of each container.

3. Stencil the T-bolt/nut torque value (35/40 ft/lbs) on the outer shell of the container.

4. Stencil the mounting hardware torque value (420 in/lb) on the clamping bands.



FIG. 8 UNIVERSAL CONTAINER - HANDLIFT TRUCK COMPATIBILITY